Data Evaluation Record on the Acute Toxicity of A21472C formulation (Dicamba, 12.4% a.i., and s-Metolachlor, 23.8% a.i.) to Terrestrial Vascular Plants: Vegetative Vigor

PMRA Submission Number {.....} **EPA MRID Number 50102116**

Data Requirement:	PMRA Data Code:	9.8.4 (TGAI) or 9.8.6 (EP)
	EPA DP Barcode:	440165
	OECD Data Point:	IIA 8.12 (TGAI) and IIIA 10.8.1.1 (EP)
	EPA Guideline:	850.4150

Test material: **A21472C Formulation (Dicamba + s-Metolachlor)**
A.I. Dicamba DGA Salt **Purity:** 17.7% as DGA salt, 12.4% as dicamba acid
A.I. s-Metolachlor **Purity:** 23.8%
Common name:
Chemical name: IUPAC:
CAS name:
CAS No:
Synonyms: SAN837/CGA77102 CS (135.6/271.2)

Primary Reviewer: Teresa Nelis **Signature:** Teresa Nelis
Senior Scientist, CDM/CSS-Dynamac JV **Date:** 12/4/17

Secondary Reviewer: Joan Gaidos **Signature:**
Senior Scientist, CDM/CSS-Dynamac JV **Date:** 12/5/17

Primary Reviewer: Michael Wagman **Date:** 4/8/19 MICHAEL WAGMAN Digitally signed by MICHAEL WAGMAN Date: 2019.04.08 15:02:01 -04'00'
Biologist, EPA/OCSPP/OPP/EFED/ERB6

Secondary Reviewer(s): Frank T, Farruggia, Ph.D., **Date:** 4/8/2019 2019.04.08 15:25:00 -04'00'
Senior Scientist, EPA/OCSPP/OPP/EFED/ERB1

This Data Evaluation Record may have been altered by the Environmental Fate and Effects Division subsequent to signing by CDM/CSS-Dynamac JV personnel.

Reference/Submission No.: {.....}

Company Code	{.....}	[For PMRA]
Active Code	{.....}	[For PMRA]
Use Site Category:	{.....}	[For PMRA]
EPA PC Code	128931 (Dicamba)	
	108800 (s-Metolachlor)	

Date Evaluation Completed: {04-08-2019}

CITATION: McKelvey, R.A., Keller, K. and J.R. Porch. 2017. S-Metolachlor and Dicamba (A21472C) - Toxicity Effects on the Vegetative Vigor of Ten Species of Plants. Final Report. Unpublished study performed by EAG Laboratories, Easton, Maryland. Study sponsored by Syngenta Crop Protection, LLC, Greensboro, North Carolina. Report/Study Number 528P-155. Study completed February 10, 2017.

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EXECUTIVE SUMMARY:

The effect of **A21472C formulation (Dicamba, 12.4% acid {17.7% dicamba DGA salt} + s-Metolachlor, 23.8%)** on the vegetative vigor of monocot (corn, *Zea mays*; oat, *Avena sativa*; onion, *Allium cepa*; and ryegrass, *Lolium perenne*) and dicot (cabbage, *Brassica oleracea*; cucumber, *Cucumis sativa;* lettuce, *Lactuca sativa;* soybean, *Glycine max*; tomato, *Lycopersicon esculentum*; and turnip, *Brassica rapa*) crops was studied. Nominal Dicamba concentrations were: 0 (negative control), 0.00257, 0.00641, 0.0160, 0.0401, 0.100, 0.250 and 0.626 lb ae/A Dicamba (cabbage, cucumber, onion); 0 (negative control), 0.0160, 0.0401, 0.100, 0.250 and 0.626 lb ae/A Dicamba (corn, ryegrass); 0 (negative control), 0.00016, 0.00041, 0.0010, 0.00257, 0.00641, 0.0160, and 0.0401 lb ae/A Dicamba (turnip); 0 (negative control), 0.0010, 0.00257, 0.00641, 0.0160, 0.0401, 0.100, 0.250 and 0.626 (oat only) lb ae/A Dicamba (oat, tomato); 0 (negative control), 0.000026, 0.000066, 0.00016, 0.00041, 0.0010, 0.00257, and 0.00641 lb ae/A Dicamba (soybean); and 0 (negative control), 0.00016, 0.00041, 0.0010, 0.00257, 0.00641, and 0.0160 lb ae/A Dicamba (lettuce); and nominal s-Metolachlor concentrations were: 0 (negative control), 0.00493, 0.0123, 0.0307, 0.0769, 0.192, 0.481, and 1.20 lb ai/A s-Metolachlor (cabbage, cucumber, onion); 0 (negative control), 0.0307, 0.0769, 0.192, 0.481, and 1.20 lb ai/A s-Metolachlor (corn, ryegrass); 0 (negative control), 0.00031, 0.00079, 0.00198, 0.00493, 0.0123, 0.0307, and 0.0769 lb ai/A s-Metolachlor (turnip); 0 (negative control), 0.00198, 0.00493, 0.0123, 0.0307, 0.0769, 0.192, 0.481, and 1.20 (oat only) lb ai/A s-Metolachlor (oat, tomato); 0 (negative control), 0.000050, 0.00013, 0.00031, 0.00079, 0.00198, 0.00493, and 0.0123 lb ai/A s-Metolachlor (soybean); and 0 (negative control), 0.00031, 0.00079, 0.00198, 0.00493, 0.0123, and 0.0307 lb ai/A s-Metolachlor (lettuce).

Concentrations of both Dicamba and s-Metolachlor were analytically confirmed at all treatment levels, and corresponding measured concentrations of Dicamba were: <0.000011 (<LOQ, negative control), 0.0025, 0.0062, 0.015, 0.039, 0.095, 0.24 and 0.59 lb ae/A Dicamba (cabbage, corn, cucumber, onion, ryegrass); <0.000011 (<LOQ, negative control), 0.00016, 0.00041, 0.0010, 0.0026, 0.0066, 0.016, 0.039, 0.10, 0.25 and 0.63 lb ae/A Dicamba (oat, tomato, turnip); <0.000011 (<LOQ, negative control), 0.000027, 0.000066, 0.00017, 0.00042, 0.0010, 0.0026, 0.0064, and 0.016 lb ae/A Dicamba (lettuce, soybean); and s-Metolachlor were: <0.000022 (<LOQ, negative control), 0.0049, 0.012, 0.030, 0.077, 0.19, 0.47 and 1.2 lb ai/A s-Metolachlor (cabbage, corn, cucumber, onion, ryegrass); <0.000022 (<LOQ, negative control), 0.00031, 0.00082, 0.0020, 0.0051, 0.013, 0.031, 0.080, 0.19, 0.49 and 1.3 lb ai/A s-Metolachlor (oat, tomato, turnip); and <0.000022 (<LOQ, negative control), 0.000052, 0.00013, 0.00033, 0.00082, 0.0020, 0.0051, 0.013, and 0.032 lb ai/A s-Metolachlor (lettuce, soybean).

The growth medium used in the vegetative vigor test was a loamy sand made from kaolinite clay, industrial quartz sand and peat, with limestone buffer added to buffer pH (loamy fine sand, pH 6.9, organic carbon 1.1%). On day 21, the surviving plants per pot were recorded and cut at soil level for measuring the plant height and dry weight.

Results are reported in terms of lb ae Dicamba/A, unless noted.

Negative control seedling survival was 100%. There were significant inhibitions in survival in cucumber, onion, and tomato. Based on measured Dicamba concentrations, significant inhibitions in cucumber survival were 17 and 40% at 0.24 and 0.59 lb ae/A; and significant inhibitions in tomato survival were 50 and 73% at the 0.10 and 0.25 lb ae/A, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$). Significant inhibition in onion survival was also 37% at 0.59 lb ae/A Dicamba compared to the negative control (Mann-Whitney U Two-Sample test, $p<0.05$).

Significant inhibitions in seedling height were found in all species, except cabbage and ryegrass. Based on measured Dicamba concentrations, significant inhibitions in onion height were 18, 19, and 52% at 0.095, 0.24, and 0.59 lb ae/A Dicamba, respectively, compared to the negative control (Williams Multiple Comparison test, $p<0.05$). Significant inhibitions in cucumber height were 35, 60, 75, 80, 82, and 83% at 0.0062, 0.015, 0.039, 0.095, 0.24, and 0.59 lb ae/A; and significant inhibitions in tomato height were 25, 55, 62, 77, and 78% at 0.0066, 0.016, 0.039, 0.10, and 0.25 lb ae/A; and significant inhibitions in turnip height were 9% at the 0.039 lb ae/A Dicamba treatment level, compared to the negative control(Jonckheere-Terpstra Step-Down test, $p<0.05$). Significant inhibitions in lettuce

height were 15, 4, 11, 10, and 18% at 0.00042, 0.0010, 0.0026, 0.0064 and 0.016 lb ae/A; and significant decreases in corn height of 10% was found at 0.59 lb ae/A; in oat height of 8 and 8% was found at 0.25 and 0.63 lb ae/A; and in soybean height of 28% was found at 0.0064 lb ae/A Dicamba, respectively, compared to the negative control (Dunnett's Multiple Comparison test, $p<0.05$).

The reviewer found significant inhibitions in seedling dry weight in all species, except ryegrass. Based on measured Dicamba concentrations, significant inhibitions in cabbage dry weight were 9, 12, 22, 30, 40 and 64% at 0.0062, 0.015, 0.039, 0.095, 0.24 and 0.59 lb ae/A; in lettuce dry weight were 33 and 54% at 0.0064 and 0.016 lb ae/A; in oat dry weight were 18 and 19% at 0.25 and 0.63 lb ae/A; in soybean dry weight were 13, 23, and 36% at 0.0010, 0.0026, and 0.0064 lb ae/A; and significant inhibitions in turnip dry weight were 11, 9, 24 and 40% at 0.0026, 0.0066, 0.016, and 0.039 lb ae/A Dicamba, respectively, compared to the negative control (Williams Multiple Comparison test, $p<0.05$). Significant decreases in cucumber dry weight of 28, 39, 58, 74, 81, and 87% were found at 0.0062, 0.015, 0.039, 0.095, 0.24, and 0.59 lb ae/A; significant decreases in onion dry weight of 34, 52, 59 and 86% were found at 0.039, 0.095, 0.24 and 0.59 lb ae/A; and significant decreases in tomato dry weight of 33, 47, 66, 73, 95 and 96% were found at 0.0026, 0.0066, 0.016, 0.039, 0.10, and 0.25 lb ae/A Dicamba, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$). For onion, the reviewer determined that the 17-28% inhibitions observed in the 0.0025, 0.0062 and 0.015 lb ae/A treatment group were likely treatment related, despite the lack of clear dose-response or statistical significance (p ranged from 0.058-0.156; Jonchkheere-Terpstra Step Down test). There was also a significant inhibition in corn dry weight of 23% at 0.59 lb ai/A Dicamba (Dunnett Multiple Comparison test, $p<0.05$).

Based on the reviewer's results, the most sensitive monocot was onion, based on dry weight, with NOAEC, IC_{05} and IC_{25} values of <0.0025, 0.00262 and 0.0248 lb ae/A measured Dicamba concentrations, respectively (<0.0049, 0.00525 and 0.0497 lb ai/A measured s-Metolachlor, respectively); and the most sensitive dicot was tomato, based on dry weight, with NOAEC and IC_{25} values of 0.0010 and 0.00208 lb ae/A measured Dicamba, respectively (0.0020 and 0.00409 lb ai/A measured s-Metolachlor, respectively).

In terms of total formulation, the most sensitive monocot was onion, based on dry weight, with NOAEC and IC_{25} values of 0.12 and 0.20 lb formulation/A, respectively; and the most sensitive dicot was tomato based on dry weight, with NOAEC and IC_{25} values of 0.0081 and 0.017 lb formulation/A, respectively.

Based on the phytotoxicity rating system used by the study author, there were slight effects in corn, ryegrass, and turnip; moderate effects in cabbage, lettuce, oat and soybean; and severe effects in cucumber, onion and tomato. Phytotoxic effects included chlorosis, necrosis, leaf curl, and stem curl. The effects were dose-related in all species except oat and ryegrass. Control plants showed none to slight symptoms in all species, except for a single control onion plant that had moderate symptomology.

Maximum Labeled Rate: Not reported

Dicamba (based on measured test concentrations)
Monocot
Most sensitive monocot: Onion, based on dry weight

EC_{50}/IC_{50}: 0.118 lb ae/A	95% C.I.: 0.076-0.184 lb ae/A
EC_{25}/IC_{25}: 0.0248 lb ae/A	95% C.I.: 0.0127-0.0434 lb ae/A
EC_{05}/IC_{05}: 0.00262 lb ae/A	95% C.I.: N/A-0.00837 lb ae/A
NOAEC: <0.0025 lb ae/A	
Slope: N/A	95% C.I.: N/A

Dicot
Most sensitive dicot: Tomato, based on dry weight

EC_{50}/IC_{50}: 0.00761 lb ae/A 95% C.I.: 0.00629-0.0092 lb ae/A
EC_{25}/IC_{25}: 0.00208 lb ae/A 95% C.I.: 0.00155-0.00272 lb ae/A
EC_{05}/IC_{05}: 0.000323 lb ae/A 95% C.I.: 1.22E-05-0.000647 lb ae/A
NOAEC: 0.0010 lb ae/A
Slope: N/A 95% C.I.: N/A

s-Metolachlor (based on measured test concentrations)
Monocot
Most sensitive monocot: Onion, based on dry weight

EC_{50}/IC_{50}: 0.237 lb ai/A 95% C.I.: 0.152-0.369 lb ai/A
EC_{25}/IC_{25}: 0.0497 lb ai/A 95% C.I.: 0.0254-0.0868 lb ai/A
EC_{05}/IC_{05}: 0.00525 lb ai/A 95% C.I.: N/A-0.0167 lb ai/A
NOAEC: <0.00492 lb ai/A
Slope: N/A 95% C.I.: N/A

Dicot
Most sensitive dicot: Tomato, based on dry weight

EC_{50}/IC_{50}: 0.0149 lb ai/A 95% C.I.: 0.0123-0.0181 lb ai/A
EC_{25}/IC_{25}: 0.00409 lb ai/A 95% C.I.: 0.00303-0.00536 lb ai/A
EC_{05}/IC_{05}: 0.000635 lb ai/A 95% C.I.: N/A-0.00128 lb ai/A
NOAEC: 0.0020 lb ai/A
Slope: N/A 95% C.I.: N/A

Total Formulation (calculated from Dicamba endpoints based on measured concentrations)
Monocot
Most sensitive monocot: Onion, based on dry weight

EC_{50}/IC_{50}: 0.95 lb/A 95% C.I.: 0.61-1.48 lb/A
EC_{25}/IC_{25}: 0.20 lb/A 95% C.I.: 0.102-0.35 lb/A
EC_{05}/IC_{05}: 0.0211 lb/A 95% C.I.: N/A-0.068 lb/A
NOAEC: <0.0207 lb/A

Dicot
Most sensitive dicot: Tomato, based on dry weight

EC_{50}/IC_{50}: 0.061 lb/A 95% C.I.: 0.051-0.074 lb/A
EC_{25}/IC_{25}: 0.017 lb/A 95% C.I.: 0.0125-0.022 lb/A
EC_{05}/IC_{05}: 0.0026 lb/A 95% C.I.: 0.00010-0.0052 lb/A
NOAEC: 0.0081 lb/A
Slope: N/A 95% C.I.: N/A

Table 1 (Tier II studies). Summary of most sensitive parameters by species (lb ai/A); Dicamba

Species	Endpoint	NOAEC	EC_{05}/IC_{05}	EC_{25}/IC_{25}	EC_{50}/IC_{50}
Cabbage	Dry weight	0.0025	0.00563	0.0618	0.327
Corn*	Dry weight	0.24	0.147	0.501	1.18
Cucumber	Height	0.0025	0.000317	0.0028	0.0127
Lettuce	Dry weight	0.0026	0.00132	0.0053	0.014

Oat*	Dry weight/Height	0.10	NC	>0.63	NC
Onion	Dry weight	<0.0025	0.00262	0.0248	0.118
Ryegrass	None	0.59	NC	>0.59	NC
Soybean	Dry weight	0.00042	0.000466	0.0037	0.0156
Tomato	Dry weight	0.0010	0.000323	0.00208	0.00761
Turnip*	Dry weight	0.0010	0.00196	0.0171	0.0771

NC – not calculable

*Endpoints and/or confidence intervals are outside the tested range of concentrations and should be interpreted with caution.

Table 1a

(Tier II studies). Summary of most sensitive parameters by species (lb ai/A); s-Metolachlor

Species	Endpoint	NOAEC	EC_{05}/IC_{05}	EC_{25}/IC_{25}	EC_{50}/IC_{50}
Cabbage	Dry weight	0.0049	0.0111	0.123	0.653
Corn*	Dry weight	0.47	0.281	1.01	2.45
Cucumber	Height	0.0049	0.000615	0.00549	0.0251
Lettuce	Dry weight	0.0051	0.00266	0.0107	0.028
Oat*	Dry weight/Height	0.19	NC	>1.3	NC
Onion	Dry weight	<0.0049	0.00525	0.0497	0.237
Ryegrass	None	1.2	NC	>1.2	NC
Soybean	Dry weight	0.00082	0.000897	0.00739	0.032
Tomato	Dry weight	0.0020	0.000635	0.00409	0.0149
Turnip*	Dry weight	0.0020	0.00363	0.0337	0.159

NC – not calculable

*Endpoints and/or confidence intervals are outside the tested range of concentrations and should be interpreted with caution.

This study is scientifically sound and is classified as acceptable.

I. MATERIALS AND METHODS

GUIDELINE FOLLOWED: This study was conducted in compliance with Series 850-Ecological Effects Test Guidelines, OCSPP Number 850.4150: Vegetative Vigor (January 2012) and the OECD Guideline for the Testing of Chemicals, Guideline 227: Terrestrial Plant Test: Vegetative Vigor (July 2006). The reviewer evaluated the study methods according to EPA Ecological Effects Test Guidelines, OCSPP Guideline 850.4150: Vegetative Vigor (January 2012).

1. The physico-chemical properties of the test material were not reported.
2. Soil CEC and % moisture were not reported.

The deficiency and deviations did not have an impact on the acceptability of this study.

COMPLIANCE: Signed and dated GLP, Quality Assurance and Data Confidentiality statements were provided. This study was conducted in compliance with Good Laboratory Practice Standards as published by U.S. Environmental Protection Agency (40 CFR Part 160); OECD Principles of Good Laboratory Practice (ENV/MC/CHEM (98) 17); and Japan MAFF (11 Nousan, Notification No. 6283, Agricultural Production Bureau, 1 October 1999). As noted, periodic analyses of well water and soil for potential contaminants were not performed according to GLP, but were performed using a certified laboratory and standard U.S. EPA analytical methods.

A. MATERIALS:

1. Test Material **A21472C formulation (Dicamba DGA salt and s-Metolachlor)**

Description: Liquid

Lot No./Batch No.: 922056 (GP160220); recertification date February 2019

Purity: Dicamba acid: 12.4% (140 g/L) {17.7% as DGA salt)
s-Metolachlor: 23.8% (269 g/L)

Stability of compound under test conditions: Dicamba measured in spray solutions were 95-102% of nominal (n=36). Dicamba spike recoveries were 95-102% (n=6). S-Metolachlor measured in spray solutions were 97-113% of nominal (n=35); one outlier was not included. S-Metolachlor spike recoveries were 95-104% (n=6). Stability was not determined.

(OECD recommends chemical stability in water and light)

Storage conditions of test chemicals: At ambient room conditions, out of direct sunlight.

Table 2. Physical/chemical properties of A21472C (Dicamba and S-Metolachlor).

Parameter	Values	Comments
Water solubility at 20°C	Not reported	
Vapor pressure	Not reported	
UV absorption	Not reported	
pKa	Not reported	
Kow	Not reported	

2. Test organism:

Monocotyledonous species: Corn (*Zea mays*, Poaceae; Nothstine Dent OG); Oat (*Avena sativa*, Poaceae; Saber); Onion (*Allium cepa*, Liliaceae; Yellow Granex Hybrid 33); and Ryegrass (*Lolium perenne*, Poaceae; Gator 3). *EPA recommends four monocots in two families, including corn.*

Dicotyledonous species: Cabbage (*Brassica oleracea*, Brassicaceae; All Seasons); Cucumber (*Cucumis sativa*, Cucurbitaceae; Tendergreen Burpless); Lettuce (*Lactuca sativa*, Asteraceae; Iceburg); Soybean (*Glycine max*, Fabaceae; Viking 2265); Tomato (*Lycopersicon esculentum*, Solanaceae; Rutgers); and Turnip (*Brassica rapa*, Brassicaceae; Purple Top White Globe). *EPA recommends six dicots in four families, including soybean and a root crop.*

OECD recommends a minimum of three species selected for testing, at least one from each of the following categories: Category 1: ryegrass, rice, oat, wheat, and sorghum; Category 2: mustard, rape, radish, turnip, and Chinese cabbage; Category 3: vetch, mung bean, red clover, fenugreek, lettuce, and cress.

Seed source: Corn and Soybean from Johnny's Selected Seeds; Oat from Powell Seeds; Onion from Park Seed Company; Cucumber, Ryegrass, Tomato, and Turnip from Meyer Seed; Cabbage and Lettuce from Sustainable Seed Company.
Prior seed treatment/sterilization: None.
Historical % germination of seed: Corn (94%), Oat (90%), Onion (90%), Ryegrass (90%), Cabbage (90%), Cucumber (80%), Lettuce (88%), Soybean (88%), Tomato (90%), and Turnip (85%).
Seed storage, if any: Not reported.

B. STUDY DESIGN:

1. Experimental Conditions

a. Limit test: None.

b. Range-finding study: All species were tested at five test concentrations, along with a negative water control. Species showed inhibitions in height in onion, oat, ryegrass, cucumber, lettuce, soybean, and tomato up to 27, 38, 20, 66, 25, 62, 67%, respectively; and inhibitions in fresh weight in onion, oat, ryegrass, cucumber, lettuce, soybean, tomato, and cabbage up to 70, 39, 29, 36, 32, 57, 83% and 28%, respectively. Tomato, cucumber and soybean effects showed a dose-response.

c. Definitive Study

Table 3: Experimental Parameters – Vegetative Vigor.

Parameters	Vegetative Vigor	
	Details	**Remarks**
		Criteria
Duration of the test	21 days	
		Recommended test duration is 14-21 days. *OECD recommends that the test be terminated no sooner than 14 days after 50 percent of the control seedlings have emerged*
Number of seeds/plants/species/ replicate	Six replicates with 5 plants (one plant per pot).	
		Ten seeds per replicate should be used. *OECD recommends a minimum of five seeds planted in each replicate within 24 hours of incorporation of the test substance. All seeds of each species for each test should be of the same size class. The seed should not be imbibed.*
Number of plants retained after thinning	N/A	
Number of replicates Control: Adjuvant control: Treated:	6 N/A 6	
		Four replicates per dose should be used. *OECD recommends a minimum of four replicates per treatment*

Test concentrations (lb ai/A) Nominal:	Dicamba 0 (negative control), 0.000026, 0.000066, 0.00016, 0.00041, 0.0010, 0.00257, 0.00641, 0.0160, 0.0401, 0.100, 0.250, and 0.626 lb ae/A Dicamba s-Metolachlor 0 (negative control), 0.000050, 0.00013, 0.00031, 0.00079, 0.00198, 0.00493, 0.0123, 0.0307, 0.0769, 0.192, 0.481, and 1.20 lb ai/A s-Metolachlor	Nominal concentrations for A21472C formulation: 0.00021, 0.00053, 0.0013, 0.0033, 0.0083, 0.0207, 0.0517, 0.129, 0.323, 0.808, 2.02, and 5.05 lb/A.
Measured:	Cabbage, cucumber, onion, corn and ryegrass (1): Dicamba <0.000011 (<LOQ, negative control), 0.0025, 0.0062, 0.015, 0.039, 0.095, 0.24, and 0.59 lb ae/A Dicamba s-Metolachlor <0.000022 (<LOQ, negative control), 0.0049, 0.012, 0.030, 0.077, 0.19, 0.47, and 1.2 lb ai/A s-Metolachlor [(1) first two conc, cabbage, cucumber, onion only] Oat, tomato, and turnip: Dicamba <0.000011 (<LOQ, negative control), 0.00016 (2), 0.00041 (2), 0.0010, 0.0026, 0.0066, 0.016, 0.039, 0.10 (3), 0.25 (3) and 0.63 (4) lb ae/A Dicamba s-Metolachlor <0.000022 (<LOQ, negative control), 0.00031 (2), 0.00082 (2), 0.0020, 0.0051, 0.013, 0.031, 0.080, 0.19 (3), 0.49 (3), and 1.3 (4) lb ai/A s-Metolachlor [(2) turnip only; (3) tomato and oat only; (4) oat only] Lettuce and soybean: Dicamba <0.000011 (<LOQ, negative control), 0.000027 (5), 0.000066 (5), 0.00017, 0.00042, 0.0010, 0.0026, 0.0064, and 0.016 (6) lb ae/A Dicamba	

Parameters	Vegetative Vigor	
	Details	**Remarks**
		Criteria
	s-Metolachlor <0.000022 (<LOQ, negative control), 0.000052 (5), 0.00013 (5), 0.00033, 0.00082, 0.0020, 0.0051, 0.013, and 0.032 (6) lb ai/A s-Metolachlor [(5) soybean only; (6) lettuce only]	*Five test concentrations should be used with a dose range of 2X or 3X progression* *OECD recommends three concentrations, preferably with application rates equivalent to 0.0 (control), 1.0, 10.0 and 100 mg substance per kg of oven-dried soil.*
Method and interval of analytical verification LOQ: LOD:	Samples of the dosing solutions were analyzed by an Agilent 1200 HPLC, fitted with Agilent 1200 VWD and YMC-PACK ODS-AM column. 0.000011 lb ae/A (Dicamba) 0.000022 lb ai/A (s-Metolachlor) N/A	
Adjuvant (type, percentage, if used)	N/A	
Test container (pot) Size/Volume Material: (glass/polystyrene)	16 cm diameter by 12 cm depth Plastic	*Non-porous containers should be used.* *OECD recommends that non-porous plastic or glazed pot be used.*
Growth facility	Greenhouse	
Method/depth of seeding	Corn, cucumber, oat and soybean: 20mm depth All others: 10mm depth	
Test material application Application time including the plant growth stage Number of applications Application interval Method of application	Post-emergence; at 1-4 leaf growth stage, except ryegrass 4-8 leaf stage 1 N/A- single application The test material was applied at 200 L/ha using a DeVries	

Parameters	Vegetative Vigor	
	Details	**Remarks** ***Criteria***
	Research Track sprayer (spray booth) with a Teejet 8002E nozzle, 20 psi, applied 41 cm from the soil surface. Calibrations of sprayer system indicated actual spraying rates of 199-201 L/ha.	
<u>Details of soil used</u> Geographic location Depth of soil collection Soil texture % sand % silt % clay pH: % organic carbon CEC Moisture at 1/3 atm (%)	 N/A N/A Loamy fine sand 88 6 6 6.9 (in water) 6.6 (in $CaCl_2$) 1.1% N/A N/A	Soil was a mixture of kaolinite clay, industrial quartz sand and peat with crushed limestone added to buffer pH. Organic matter 1.9% *Soil mixes containing sandy loam, loam, or clay loam soil with no greater than 2% organic matter are preferable. Glass beads, rock wool, and 100% acid washed sand are not preferred.* *OECD prefers the soil to be sieved (0.5 cm) to remove coarse fragments. Carbon content should not exceed 1.5% (3% organic matter). Fine particles (under 20um) makeup should be between 10 and 20%. The recommended pH is between 5.0 and 7.5.*
Details of nutrient medium, if used	N/A	
<u>Watering regime and schedules</u> Water source/type: Volume applied: Interval of application: Method of application:	 Laboratory well water. Not specified. As needed. The plants were bottom watered every one to three days as needed.	 *EPA prefers that bottom watering be utilized for Vegetative Vigor studies so that the chemical is not leached out of the soil during the test.*
Any pest control method/fertilization, if used	A slow release fertilizer was added to soil before planting.	

Parameters	Vegetative Vigor	
	Details	**Remarks**
		Criteria
Test conditions Temperature: Photoperiod: Light intensity and quality: Relative humidity: Temperature: Photoperiod: Light intensity and quality: Relative humidity: Temperature: Photoperiod: Light intensity and quality: Relative humidity:	Onion, ryegrass, corn, cabbage, and cucumber Mean 23.47 °C; range 16.78-31.87°C 16L:8D Natural sunlight supplemented with artificial light. Range 11.1-16.5 moles PAR Mean 66.45%; range 22.94-91.00% Lettuce Mean 23.35°C; range 16.78-31.87°C 16L:8D Natural sunlight supplemented with artificial light. Range 11.1-16.5 moles PAR Mean 65.41%; range 22.97-91.00% Oat and turnip Mean 22.52°C; range 15.63-41.15°C 16L:8D Natural sunlight supplemented with artificial light. Range 10.2-18.2 moles PAR Mean 69.16%; range 25.88-95.50%	*EPA prefers that the cold vs warm loving plants be tested in two separate groups to optimize plant growth.* *OECD prefers that the temperature, humidity and light conditions be suitable for maintaining normal growth of each species for the test period.*
Reference chemical (if used) Name: Concentrations:	N/A	
Other parameters, if any	None	

2. Observations:

Table 4: Observation Parameters - Vegetative Vigor.

Parameters	Vegetative Vigor	
	Details	**Remarks**
Parameters measured (e.g., number of germinated seeds, emerged seedlings, plant height, dry weight or other endpoints)	- Survival - Height - Mean dry weight - Phytotoxicity	
Measurement technique for each parameter	Phytotoxicity was visually determined. Height was measured to the apical meristem or the tip of the longest leaf. Mean plant weight was estimated by cutting plant at soil surface and measuring the total dry weight per replicate divided by number of plants weighed following oven drying.	
Observation intervals	Each pot was inspected weekly and phytotoxicity assessments performed. Plant height and dry weight were recorded at study termination.	
Other observations, if any	N/A	
Were raw data included?	Yes	
Phytotoxicity rating system, if used	0- No effect; 10-30- Slight effect; 40-60- Moderate effect; 70-90- Severe effect; 100 = death of entire plant.	Frans, Robert E. and Ronald E. Talbert. 1977. Design of Field Experiments and the Measurement and Analysis of Plant Responses, pp. 15-23, in B. Truelove, ed., Research Methods in Weed Science. Southern Weed Science Society, Auburn University, Alabama

II. RESULTS and DISCUSSION:

A. INHIBITORY EFFECTS:

Results reported in terms of lb ae Dicamba/A, unless otherwise noted.

1. Vegetative Vigor:

The study author and reviewer found negative control survival was 100%. The study author found significant inhibitions in survival in cucumber, onion, and tomato. Based on nominal Dicamba concentrations, significant inhibitions in cucumber survival were 17 and 40% at 0.250 and 0.626 lb ae/A; significant inhibition in onion survival was 37% at 0.626 lb ae/A; and significant inhibitions in tomato survival were 50 and 73% at 0.100 and 0.250 lb ae/A Dicamba, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ at 0.250 lb ae/A for cucumber).

The reviewer also found significant inhibitions in survival in cucumber, onion, and tomato. Based on measured Dicamba concentrations, significant inhibitions in cucumber survival were 17 and 40% at 0.24 and 0.59 lb ae/A; and significant inhibitions in tomato survival were 50 and 73% at the 0.10 and 0.25 lb ae/A, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$). Significant inhibition in onion survival was also 37% at 0.59 lb ae/A Dicamba compared to the negative control (Mann-Whitney U Two-Sample test, $p<0.05$).

The study author found significant inhibitions in seedling height in all species, except cabbage, ryegrass, and turnip. Based on nominal Dicamba concentrations, significant inhibitions in cucumber height were 35, 60, 75, 80, 82, and 83% at 0.00641, 0.0160, 0.0401, 0.100, 0.250, and 0.626 lb ae/A; in lettuce height were 15, 11, 10, and 18% at 0.00041, 0.00257, 0.00641 and 0.0160 lb ae/A; in oat height were 8 and 8% at 0.250 and 0.626 lb ae/A; and in tomato height were 25, 55, 62, 77, and 78% at 0.00641, 0.0160, 0.0401, 0.100, and 0.250 lb ae/A, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ at 0.00257 and 0.00641 lb ae/A for lettuce). Significant inhibitions in onion height were also 18, 19, and 52% at 0.100, 0.250, and 0.626 lb ae/A, respectively (Dunnett's test, $p<0.01$; except $p<0.05$ at 0.100 and 0.250 lb ae/A); were 10% in corn height at 0.626 lb ae/A (Dunnett's test, $p<0.05$); and were 28% in soybean height, at 0.00641 lb ae/A Dicamba compared to the negative control (Dunnett's test, $p<0.01$).

The reviewer also found significant inhibitions in seedling height compared to the negative control in all species, except cabbage and ryegrass. Based on measured Dicamba concentrations, significant inhibitions in onion height were 18, 19, and 52% at 0.095, 0.24, and 0.59 lb ae/A Dicamba, respectively, compared to the negative control (Williams Multiple Comparison test, $p<0.05$). Significant inhibitions in cucumber height were 35, 60, 75, 80, 82, and 83% at 0.0062, 0.015, 0.039, 0.095, 0.24, and 0.59 lb ae/A; and significant inhibitions in tomato height were 25, 55, 62, 77, and 78% at 0.0066, 0.016, 0.039, 0.10, and 0.25 lb ae/A; and significant decrease in turnip height was 9% at the 0.039 lb ae/A Dicamba treatment level, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$). Significant decreases in corn height of 10% was found at 0.59 lb ae/A; in oat height of 8 and 8% was found at 0.25 and 0.63 lb ae/A; and in soybean height of 28% was found at 0.0064 lb ae/A ; in lettuce height of 15, 4, 11, 10, and 18% at 0.00042, 0.0010, 0.0026, 0.0064 and 0.016 lb ae/A Dicamba, respectively, compared to the negative control (Dunnett's test).

The study author found significant inhibitions in dry weight compared to the negative control in all species, except ryegrass. Based on nominal Dicamba concentrations, significant inhibitions in cabbage dry weight were 12, 22, 30, 40 and 64% at 0.0160, 0.0401, 0.100, 0.250 and 0.626 lb ae/A; in cucumber dry weight were 28, 40, 58, 74, 81, and 87% at 0.00641, 0.0160, 0.0401, 0.100, 0.250, and 0.626 lb ae/A; in onion dry weight were 28, 24, 34, 52, 59 and 86% at 0.00257, 0.0160, 0.0401, 0.100, 0.250 and 0.626 lb ae/A; and in tomato dry weight were 33, 47, 66, 73, 95 and 96% at 0.00257, 0.00641, 0.0160, 0.0401, 0.100, and 0.250

lb ae/A, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ for 0.0160 lb ae/A for cabbage and onion). Significant decreases in lettuce dry weight of 33 and 54% were found at 0.00641 and 0.0160 lb ae/A (Dunnett's test, $p<0.05$ at 0.00641 lb ae/A; $p<0.01$ at 0.0160 lb ae/A); and significant decreases in soybean dry weight of 13, 22, and 36% were found at 0.0010, 0.00257, and 0.00641 lb ae/A (Dunnett's test, $p<0.01$; except $p<0.05$ at 0.0010 lb ae/A). Significant inhibitions in corn dry weight were 23% at 0.626 lb ae/A; significant inhibitions in oat dry weight were 18 and 19% at 0.250 and 0.626 lb ae/A; and significant inhibitions in turnip dry weight were 24 and 40% at 0.0160 and 0.0401 lb ae/A Dicamba, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

The reviewer also found significant inhibitions in seedling dry weight compared to the negative control in all species, except ryegrass. Based on measured Dicamba concentrations, significant inhibitions in cabbage dry weight were 9, 12, 22, 30, 40 and 64% at 0.0062, 0.015, 0.039, 0.095, 0.24 and 0.59 lb ai/A; in lettuce dry weight were 33 and 54% at 0.0064 and 0.016 lb ae/A; in oat dry weight were 18 and 19% at 0.25 and 0.63 lb ae/A; in soybean dry weight were 13, 23, and 36% at 0.0010, 0.0026, and 0.0064 lb ae/A; and significant inhibitions in turnip dry weight were 11, 9, 24 and 40% at 0.0026, 0.0066, 0.016, and 0.039 lb ae/A Dicamba, respectively, compared to the negative control (Williams Multiple Comparison test, $p<0.05$). Significant decreases in cucumber dry weight of 28, 39, 58, 74, 81, and 87% were found at 0.0062, 0.015, 0.039, 0.095, 0.24, and 0.59 lb ae/A; significant decreases in onion dry weight of 34, 52, 59 and 86% were found at 0.039, 0.095, 0.24 and 0.59 lb ae/A; and significant decreases in tomato dry weight of 33, 47, 66, 73, 95 and 96% were found at 0.0026, 0.0066, 0.016, 0.039, 0.10, and 0.25 lb ae/A Dicamba, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$). For onion, the reviewer also determined that the 17% -28% inhibitions observed in the 0.0025, 0.0062 and 0.015 lb ae/A treatment group were likely treatment related, despite the lack of clear dose-response or statistical significance (p ranged from 0.058-0.156; Jonckheere-Terpstra Step-Down test). There was also a significant inhibition in corn dry weight of 23% at 0.59 lb ae/A Dicamba (Dunnett Multiple Comparison test, $p<0.05$).

Based on the study author's results, the most sensitive monocot was onion, based on dry weight, with NOER and ER_{25} values of 0.00641 and 0.00895 lb ae/A nominal Dicamba concentrations, respectively (0.0123 and 0.0172 lb ai/A nominal s-Metolachlor, respectively); and the most sensitive dicot was tomato, based on dry weight, with NOER and ER_{25} values of 0.0010 and 0.00219 lb ae/A nominal Dicamba, respectively (0.00197 and 0.00421 lb ai/A nominal s-Metolachlor, respectively). In terms of total formulation, the most sensitive monocot was onion, based on dry weight, with NOER and ER_{25} values of 0.0517 and 0.0722 lb formulation/A, respectively; and the most sensitive dicot was tomato based on dry weight, with NOER and ER_{25} values of 0.00806 and 0.0177 lb formulation/A, respectively.

Based on the phytotoxicity rating system used by the study author, there were slight effects in corn, ryegrass, and turnip; moderate effects in cabbage, lettuce, oat and soybean; and severe effects in cucumber, onion and tomato. Phytotoxic effects included chlorosis, necrosis, leaf curl, and stem curl. The effects were dose-related in all species except oat and ryegrass. Control plants showed none to slight symptoms in all species, except for moderate effects (60) in one control onion plant.

B. REPORTED STATISTICS:

Plant shoot height, shoot dry weight, and percent survival means were determined. Dunnett's test was used to establish the LOER and NOER by determining which treatment groups differed significantly ($p>0.01$ and $p>0.05$) from the control group. Mean survival, dry weight, and height of the control and treatment groups were compared using the DUNNETT option of the GLM (general linear model) procedure of SAS version 9.4. Statistical analyses for species also included, if appropriate, the determination of effect rates (ER estimates) and their confidence limits using the non-linear regression analysis of Bruce and Versteeg when reductions in test endpoints among one or more treatment groups were 25% or more relative to control means. Analyses were conducted using the NLIN procedure of SAS version 9.4. Alternatively, if non-linear regression resulted in poor

model fit or generated obscure estimates relative to ANOVA endpoints (i.e. NOER and LOER) or generated estimates with unbounded confidence intervals ER_x estimates and their 95% confidence intervals were calculated using the linear interpolation method of Norberg-King. Nominal concentrations were used for all analyses.

Table 5: Reported Effect of Dicamba on 21-Day Vegetative Vigor

Species	Results summary for height (lb ai/A)									
	height (cm)	NOER	ER_{05}	95%CI	ER_{25}	95%CI	ER_{50}	95%CI	slope	95%CI
Cabbage	20.7-23.8	0.626	ND	N/A	>0.626	N/A	>0.626	N/A	N/A	N/A
Corn[1]	92.1-109	0.250	ND	N/A	>0.626	N/A	>0.626	N/A	N/A	N/A
Cucumber[2]	13.3-76.8	0.00257	ND	N/A	0.00486	0.00357-0.00639	0.0121	0.00782-0.0139	N/A	N/A
Lettuce[3]	13.7-16.7	0.0010	ND	N/A	>0.0160	N/A	>0.0160	N/A	N/A	N/A
Oat[4]	63-68.4	0.100	ND	N/A	>0.626	N/A	>0.626	N/A	N/A	N/A
Onion[5]	17-35.6	0.0401	ND	N/A	0.279	0.190-0.410	>0.626	N/A	N/A	N/A
Ryegrass	29.7-31.6	0.626	ND	N/A	>0.626	N/A	>0.626	N/A	N/A	N/A
Soybean[6]	19.7-27.8	0.00257	ND	N/A	0.00605	0.00497-0.00736	>0.00641	N/A	N/A	N/A
Tomato[7]	10.6-50.5	0.00257	ND	N/A	0.00361	0.00180-0.00724	0.0182	0.0116-0.0285	N/A	N/A
Turnip	32.3-35.5	0.0401	ND	N/A	>0.0401	N/A	>0.0401	N/A	N/A	N/A

ND- Not determined. NC- Not calculable. N/A – Not Applicable.

1 Significant decrease in corn height, inhibition of 10% at the 0.626 lb ai/A Dicamba treatment level compared to the negative control (Dunnett's test, $p<0.05$).

2 Significant decrease in cucumber height, inhibition of 35, 60, 75, 80, 82, and 83% at the 0.00641, 0.0160, 0.0401, 0.100, 0.250, and 0.626 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

3 Significant decrease in lettuce height, inhibition of 15, 11, 10, and 18% at the 0.00041, 0.00257, 0.00641 and 0.0160 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ at 0.00257 and 0.00641 lb ai/A).

4 Significant decrease in oat height, inhibition of 8 and 8% at the 0.250 and 0.626 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

5 Significant decrease in onion height, inhibition of 18, 19, and 52% at the 0.100, 0.250, and 0.626 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ at 0.100 and 0.250 lb ai/A).

6 Significant decrease in soybean height, inhibition of 28% at the 0.00641 lb ai/A Dicamba treatment level compared to the negative control (Dunnett's test, $p<0.01$).

7 Significant decrease in tomato height, inhibition of 25, 55, 62, 77, and 78% at the 0.00641, 0.0160, 0.0401, 0.100, and 0.250 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

Table 5a: Reported Effect of Dicamba on 21-Day Vegetative Vigor

Species	Results summary for biomass (lb ai/A)									
	weight (g)	NOER	ER_{05}	95%CI	ER_{25}	95%CI	ER_{50}	95%CI	slope	95%CI
Cabbage[1]	1.07-2.96	0.00641	ND	N/A	0.0721	0.0451-0.115	0.342	0.266-0.440	N/A	N/A
Corn[2]	3.33-5.23	0.250	ND	N/A	>0.626	N/A	>0.626	N/A	N/A	N/A
Cucumber[3]	0.887-6.73	0.00257	ND	N/A	0.00438	0.00242-0.00790	0.0249	0.0168-0.0370	N/A	N/A
Lettuce[4]	0.366-0.834	0.00257	ND	N/A	0.00525	0.00237-0.0116	0.0141	0.00873-0.0229	N/A	N/A
Oat[5]	1.15-1.42	0.100	ND	N/A	>0.626	N/A	>0.626	N/A	N/A	N/A
Onion[6]	0.0437-0.314	0.00641	ND	N/A	0.00895	0.0023-0.0349	0.0167	0.00530-0.0526	N/A	N/A
Ryegrass	0.905-1	0.626	ND	N/A	>0.626	N/A	>0.626	N/A	N/A	N/A
Soybean[7]	0.947-1.47	0.000413	ND	N/A	0.00370	0.00251-0.00545	>0.00641	N/A	N/A	N/A
Tomato[8]	0.206-5.27	0.0010	ND	N/A	0.00219	0.00123-0.00391	0.00785	0.00523-0.0118	N/A	N/A
Turnip[9]	3.22-5.42	0.00641	ND	N/A	0.0173	0.0112-0.0267	>0.0401	N/A	N/A	N/A

ND- Not determined. NC- Not calculable. N/A – Not Applicable.

1 Significant decrease in cabbage dry weight, inhibition of 12, 22, 30, 40 and 64% at the 0.0160, 0.0401, 0.100, 0.250 and 0.626 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ at 0.0160 lb ai/A).

2 Significant decrease in corn dry weight, inhibition of 23% at the 0.626 lb ai/A Dicamba treatment level compared to the negative control (Dunnett's test, $p<0.05$).

3 Significant decrease in cucumber dry weight, inhibition of 28, 40, 58, 74, 81, and 87% at the 0.00641, 0.0160, 0.0401, 0.100, 0.250, and 0.626 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

4 Significant decrease in lettuce dry weight, inhibition of 33 and 54% at the 0.00641 and 0.0160 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ at 0.00641 lb ai/A).

5 Significant decrease in oat dry weight, inhibition of 18 and 19% at the 0.250 and 0.626 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

6 Significant decrease in onion dry weight, inhibition of 28, 24, 34, 52, 59 and 86% at the 0.00257, 0.0160, 0.0401, 0.100, 0.250 and 0.626 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ for 0.0160 lb ai/A). The effect at 0.00257 lb ai/A was considered incidental to treatment; as a result, the study author reported the NOER as 0.00641 lb ai/A.

7 Significant decrease in soybean dry weight, inhibition of 13, 22, and 36% at the 0.0010, 0.00257, and 0.00641 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ at 0.0010 lb ai/A).

8 Significant decrease in tomato dry weight, inhibition of 33, 47, 66, 73, 95 and 96% at the 0.00257, 0.00641, 0.0160, 0.0401, 0.100, and 0.250 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

9 Significant decrease in turnip dry weight, inhibition of 24 and 40% at the 0.0160 and 0.0401 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

Table 5b: Reported Effect of Dicamba on 21-Day Vegetative Vigor

Species	Results summary for survival (lb ai/A)									
	%	NOER	ER_{05}	95%CI	ER_{25}	95%CI	ER_{50}	95%CI	slope	95%CI
Cabbage	100	0.626	ND	N/A	>0.626	N/A	>0.626	N/A	N/A	N/A
Corn	100	0.626	ND	N/A	>0.626	N/A	>0.626	N/A	N/A	N/A
Cucumber[1]	60-100	0.100	ND	N/A	0.378	0.286-0.498	>0.626	N/A	N/A	N/A
Lettuce	97-100	0.0160	ND	N/A	>0.0160	N/A	>0.0160	N/A	N/A	N/A
Oat	97-100	0.626	ND	N/A	>0.626	N/A	>0.626	N/A	N/A	N/A
Onion[2]	63-100	0.250	ND	N/A	0.510	0.400-0.651	>0.626	N/A	N/A	N/A
Ryegrass	100	0.626	ND	N/A	>0.626	N/A	>0.626	N/A	N/A	N/A
Soybean	100	0.00641	ND	N/A	>0.00641	N/A	>0.00641	N/A	N/A	N/A
Tomato[3]	27-100	0.0401	ND	N/A	0.0599	0.0426-0.0841	0.121	0.0990-0.148	N/A	N/A
Turnip	97-100	0.0401	ND	N/A	>0.0401	N/A	>0.0401	N/A	N/A	N/A

ND- Not determined. NC- Not calculable. N/A – Not Applicable.

1 Significant decrease in cucumber survival, inhibition of 17 and 40% at the 0.250 and 0.626 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ at 0.250 lb ai/A).

2 Significant decrease in onion survival, inhibition of 37% at the 0.626 lb ai/A Dicamba treatment level compared to the negative control (Dunnett's test, $p<0.01$).

3 Significant decrease in tomato survival, inhibition of 50 and 73% at the 0.100 and 0.250 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

Table 6: Reported Effect of s-Metolachlor on 21-Day Vegetative Vigor

Species	Results summary for height (lb ai/A)									
	height (cm)	NOER	ER_{05}	95%CI	ER_{25}	95%CI	ER_{50}	95%CI	slope	95%CI
Cabbage	20.7-23.8	1.20	ND	N/A	>1.20	N/A	>1.20	N/A	N/A	N/A
Corn[1]	92.1-109	0.481	ND	N/A	>1.20	N/A	>1.20	N/A	N/A	N/A
Cucumber[2]	13.3-76.8	0.00493	ND	N/A	0.00933	0.00686-0.0123	0.0233	0.0150-0.0268	N/A	N/A
Lettuce	13.7-16.7	0.00197	ND	N/A	0.0308	N/A	0.0308	N/A	N/A	N/A
Oat[3]	63-68.4	0.192	ND	N/A	>1.20	N/A	>1.20	N/A	N/A	N/A
Onion[4]	17-35.6	0.0769	ND	N/A	0.536	0.3652-0.787	>1.20	N/A	N/A	N/A
Ryegrass[5]	29.7-31.6	1.20	ND	N/A	>1.20	N/A	>1.20	N/A	N/A	N/A
Soybean[6]	19.7-27.8	0.00493	ND	N/A	0.0116	0.00955-0.0141	0.0123	N/A	N/A	N/A
Tomato[7]	10.6-50.5	0.00493	ND	N/A	0.00692	0.00345-0.0139	0.0350	0.0223-0.0548	N/A	N/A
Turnip[8]	32.3-35.5	0.0769	ND	N/A	>0.0769	N/A	>0.0769	N/A	N/A	N/A

ND- Not determined. NC- Not calculable. N/A – Not Applicable.

1 Significant decrease in corn height, inhibition of 10% at the 1.20 lb ai/A s-Metolachlor treatment level compared to the negative control (Dunnett's test, $p<0.05$).

2 Significant decrease in cucumber height, inhibition of 35, 60, 75, 80, 82, and 83% at the 0.0123, 0.0307, 0.0769, 0.192, 0.481, and 1.20 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

3 Significant decrease in lettuce height, inhibition of 15, 11, 10, and 18% at the 0.00079, 0.00493, 0.0123 and 0.0307 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ at 0.00493 and 0.0123 lb ai/A).

4 Significant decrease in oat height, inhibition of 8 and 8% at the 0.481, and 1.20 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

5 Significant decrease in onion height, inhibition of 18, 19, and 52% at the 0.192, 0.481, and 1.20 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ at 0.192 and 0.481 lb ai/A).

6 Significant decrease in soybean height, inhibition of 28% at the 0.0123 lb ai/A s-Metolachlor treatment level compared to the negative control (Dunnett's test, $p<0.01$).

7 Significant decrease in tomato height, inhibition of 25, 55, 62, 77, and 78% at the 0.0123, 0.0307, 0.0769, 0.192, and 0.481 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

Table 6a: Reported Effect of s-Metolachlor on 21-Day Vegetative Vigor

Species	Results summary for biomass (lb ai/A)									
	weight (g)	NOER	ER_{05}	95%CI	ER_{25}	95%CI	ER_{50}	95%CI	slope	95%CI
Cabbage[1]	1.07-2.96	0.0123	ND	N/A	0.138	0.0865-0.222	0.657	0.510-0.845	N/A	N/A
Corn[2]	3.33-5.23	0.481	ND	N/A	>1.20	N/A	>1.20	N/A	N/A	N/A
Cucumber[3]	0.887-6.73	0.00493	ND	N/A	0.00840	0.00465-0.0152	0.048	0.0322-0.0709	N/A	N/A
Lettuce[4]	0.366-0.834	0.00493	ND	N/A	0.0101	0.00455-0.0223	0.0272	0.0168-0.0440	N/A	N/A
Oat[5]	1.15-1.42	0.192	ND	N/A	>1.20	N/A	>1.20	N/A	N/A	N/A
Onion[6]	0.0437-0.314	0.0123	ND	N/A	0.0172	0.00441-0.0670	0.032	0.0102-0.101	N/A	N/A
Ryegrass	0.905-1	1.20	ND	N/A	>1.20	N/A	>1.20	N/A	N/A	N/A
Soybean[7]	0.947-1.47	0.000793	ND	N/A	0.00710	0.00482-0.0105	>0.0123	N/A	N/A	N/A
Tomato[8]	0.206-5.27	0.00197	ND	N/A	0.00421	0.00236-0.00750	0.0151	0.0100-0.0226	N/A	N/A
Turnip[9]	3.22-5.42	0.0123	ND	N/A	0.0332	0.0215-0.0512	>0.0769	N/A	N/A	N/A

ND- Not determined. NC- Not calculable. N/A – Not Applicable.

1 Significant decrease in cabbage dry weight, inhibition of 12, 22, 30, 40 and 64% at the 0.0307, 0.0769, 0.192, 0.481 and 1.20 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ at 0.0307 lb ai/A).

2 Significant decrease in corn dry weight, inhibition of 23% at the 1.20 lb ai/A s-Metolachlor treatment level compared to the negative control (Dunnett's test, $p<0.05$).

3 Significant decrease in cucumber dry weight, inhibition of 28, 40, 58, 74, 81, and 87% at the 0.0123, 0.0307, 0.0769, 0.192, 0.481, and 1.20 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

4 Significant decrease in lettuce dry weight, inhibition of 33 and 54% at the 0.0123 and 0.0307 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ at 0.0123 lb ai/A).

5 Significant decrease in oat dry weight, inhibition of 18 and 19% at the 0.481, and 1.20 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

6 Significant decrease in onion dry weight, inhibition of 28, 24, 34, 52, 59 and 86% at the 0.00493, 0.0307, 0.0769, 0.192, 0.481 and 1.20 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ for 0.0307 lb ai/A). The effect at 0.00493 lb ai/A was considered incidental to treatment; as a result, the study author reported the NOER as 0.0123 lb ai/A.

7 Significant decrease in soybean dry weight, inhibition of 13, 22, and 36% at the 0.00198, 0.00493, and 0.0123 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ at 0.00198 lb ai/A).

8 Significant decrease in tomato dry weight, inhibition of 33, 47, 66, 73, 95 and 96% at the 0.00493, 0.0123, 0.0307, 0.0769, 0.192, and 0.481 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

9 Significant decrease in turnip dry weight, inhibition of 24 and 40% at the 0.0307 and 0.0769 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

Table 6c: Reported Effect of s-Metolachlor on 21-Day Vegetative Vigor

Species	Results summary for survival (lb ai/A)									
	%	NOER	ER_{05}	95%CI	ER_{25}	95%CI	ER_{50}	95%CI	slope	95%CI
Cabbage	100	1.20	ND	N/A	>1.20	N/A	>1.20	N/A	N/A	N/A
Corn	100	1.20	ND	N/A	>1.20	N/A	>1.20	N/A	N/A	N/A
Cucumber[1]	60-100	0.192	ND	N/A	0.725	0.550-0.956	>1.20	N/A	N/A	N/A
Lettuce	97-100	0.0308	ND	N/A	>0.0308	N/A	>0.0308	N/A	N/A	N/A
Oat	97-100	1.20	ND	N/A	>1.20	N/A	>1.20	N/A	N/A	N/A
Onion[2]	63-100	0.4806	ND	N/A	0.979	0.767-1.25	>1.20	N/A	N/A	N/A
Ryegrass	100	1.20	ND	N/A	>1.20	N/A	>1.20	N/A	N/A	N/A
Soybean	100	0.0123	ND	N/A	>0.0123	N/A	>0.0123	N/A	N/A	N/A
Tomato[3]	27-100	0.0769	ND	N/A	0.115	0.0818-0.161	0.232	0.190-0.283	N/A	N/A
Turnip	97-100	0.0769	ND	N/A	>0.0769	N/A	>0.0769	N/A	N/A	N/A

ND- Not determined. NC- Not calculable. N/A – Not Applicable.

1 Significant decrease in cucumber survival, inhibition of 17 and 40% at the 0.481 and 1.20 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$; except $p<0.05$ at 0.481 lb ai/A).

2 Significant decrease in onion survival, inhibition of 37% at the 1.20 lb ai/A s-Metolachlor treatment level compared to the negative control (Dunnett's test, $p<0.01$).

3 Significant decrease in tomato survival, inhibition of 50 and 73% at the 0.192 and 0.481 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett's test, $p<0.01$).

Plant Injury Index*											
Control	Cabbage	Corn	Cucumber	Lettuce	Oat	Onion	Ryegrass	Soybean	Tomato	Turnip	Formulation Blank
0-12	0-36	0-26	0-88	0-46	0-32	0-92	0-12	0-48	0-100	0-26	N/A

*0- No effect; 10-30- Slight effect; 40-60- Moderate effect; 70-90- Severe effect; 100 = death of entire plant.

C. VERIFICATION OF STATISTICAL RESULTS BY THE REVIEWER:

All analyses were conducted comparing treated to the negative control. These analyses were conducted using CETIS version 1.9.2.8 and backend settings approved for use by EFED on 7/25/2017. Data for each endpoint were tested to determine if their distributions were normal and if their variances were homogeneous using Shapiro-Wilk's and Levene's tests, respectively. Data that satisfied these assumptions were subjected to Dunnett's and William's tests, and data that did not satisfy these assumptions were subjected to the non-parametric Mann-Whitney U and Jonckheere's tests. Linear (survival) and nonlinear (height and dry weight) regression models were used to interpret EC/ICx values. Measured concentrations of Dicamba and s-Metolachlor were used in all analyses.

Table 7: Reviewer-Verified Effect of Dicamba on 21-Day Vegetative Vigor

Species	Results summary for height (lb ai/A)									
	height (cm)	NOAEC	IC_{05}	95%CI	IC_{25}	95%CI	IC_{50}	95%CI	slope	95%CI
Cabbage	20.7-23.8	0.59	NC	N/A	>0.59	N/A	>0.59	N/A	N/A	N/A
Corn[1]	92.1-109	0.24	NC	N/A	>0.59	N/A	NC	N/A	N/A	N/A
Cucumber[2]	13.3-76.8	0.0025	0.000317	N/A-0.00086	0.0028	0.00179-0.00414	0.0127	0.00989-0.0164	N/A	N/A
Lettuce[3]*	13.7-16.7	0.00017	NC	N/A	>0.016	N/A	NC	N/A	N/A	N/A
Oat[4]*	63-68.4	0.10	NC	N/A	>0.63	N/A	NC	N/A	N/A	N/A
Onion[5]	17-35.6	0.039	0.0699	N/A-0.121	0.256	0.183-0.342	0.633	0.446-0.898	N/A	N/A
Ryegrass*	29.7-31.6	0.59	NC	N/A	>0.59	N/A	NC	N/A	N/A	N/A
Soybean[6]	19.7-27.8	0.0026	0.00252	N/A-0.00393	0.00605	0.00484-0.00731	0.0111	0.00634-0.0195	N/A	N/A
Tomato[7]	10.6-50.5	0.0026	0.00082	0.000111-0.00158	0.00524	0.00384-0.00693	0.019	0.0154-0.0235	N/A	N/A
Turnip[8]*	32.3-35.5	0.016	0.0293	0.00842-0.049	0.141	N/A-1.43	NC	N/A	N/A	N/A

ND- Not determined. NC- Not calculable. N/A – Not Applicable.

*Endpoints and/or confidence intervals are outside tested range of concentrations and should be interpreted with caution.

1 Significant decrease in corn height, inhibition of 10% at the 0.59 lb ai/A Dicamba treatment level compared to the negative control (Dunnett Multiple Comparison test, $p<0.05$). Due to poor fit, regression was not used to calculate the IC_{25} or IC_{50}

2 Significant decrease in cucumber height, inhibition of 35, 60, 75, 80, 82, and 83% at the 0.0062, 0.015, 0.039, 0.095, 0.24, and 0.59 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$).

3 Significant decrease in lettuce height, inhibition of 15, 4, 11, 10, and 18% at the 0.00042, 0.0010, 0.0026, 0.0064 and 0.016 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett Multiple Comparison test, $p<0.05$). ICx endpoints were not calculated due to poor regression fit.

4 Significant decrease in oat height, inhibition of 8 and 8% at the 0.25 and 0.63 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Dunnett Multiple Comparison test, $p<0.05$). Due to poor fit, regression was not used to calculate the IC_{25} or IC_{50}

5 Significant decrease in onion height, inhibition of 18, 19, and 52% at the 0.095, 0.24, and 0.59 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Williams Multiple Comparison test, $p<0.05$).

6 Significant decrease in soybean height, inhibition of 28% at the 0.0064 lb ai/A Dicamba treatment level compared to the negative control (Dunnett Multiple Comparison test, $p<0.05$).

7 Significant decrease in tomato height, inhibition of 25, 55, 62, 77, and 78% at the 0.0066, 0.016, 0.039, 0.10, and 0.25 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$).

[8] Significant decrease in turnip height, inhibition of 9% at the 0.039 lb ae/A Dicamba treatment level, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$).

Table 7a: Reviewer-Verified Effect of Dicamba on 21-Day Vegetative Vigor

Species	Results summary for biomass (lb ai/A)									
	weight (g)	NOAEC	IC_{05}	95%CI	IC_{25}	95%CI	IC_{50}	95%CI	slope	95%CI
Cabbage[1]	1.07-2.96	0.0025	0.00563	0.00186-0.0105	0.0618	0.0454-0.082	0.327	0.25-0.427	N/A	N/A
Corn[2]*	3.33-5.23	0.24	0.147	N/A-0.302	0.501	0.317-0.723	1.18	0.395-3.5	N/A	N/A
Cucumber[3]	0.887-6.73	0.0025	0.000562	4.54E-05-0.00125	0.00536	0.00392-0.00715	0.0257	0.0211-0.0314	N/A	N/A
Lettuce[4]	0.366-0.834	0.0026	0.00132	N/A-0.00317	0.0053	0.00252-0.00911	0.014	0.00771-0.0253	N/A	N/A
Oat[5]*	1.15-1.42	0.10	NC	N/A	>0.63	N/A	NC	N/A	N/A	N/A
Onion[6]	0.0437-0.314	<0.0025	0.00262	N/A-0.00837	0.0248	0.0127-0.0434	0.118	0.076-0.184	N/A	N/A
Ryegrass	0.905-1	0.59	NC	N/A	>0.59	N/A	NC	N/A	N/A	N/A
Soybean[7]	0.947-1.47	0.00042	0.000466	0.000104-0.000899	0.0037	0.00264-0.00502	0.0156	0.00747-0.0326	N/A	N/A
Tomato[8]	0.206-5.27	0.0010	0.000323	1.22E-05-0.000647	0.00208	0.00155-0.00272	0.00761	0.00629-0.0092	N/A	N/A
Turnip[9]*	3.22-5.42	0.0010	0.00196	0.000448-0.00383	0.0171	0.0122-0.0232	0.0771	0.0408-0.146	N/A	N/A

ND- Not determined. NC- Not calculable. N/A – Not Applicable.

*Endpoints and/or confidence intervals are outside tested range of concentrations and should be interpreted with caution.

1 Significant decrease in cabbage dry weight, inhibition of 9, 12, 22, 30, 40 and 64% at the 0.0062, 0.015, 0.039, 0.095, 0.24 and 0.59 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Williams Multiple Comparison test, $p<0.05$).

2 Significant decrease in corn dry weight, inhibition of 23% at the 0.59 lb ai/A Dicamba treatment level compared to the negative control (Dunnett Multiple Comparison test, $p<0.05$).

3 Significant decrease in cucumber dry weight, inhibition of 28, 39, 58, 74, 81, and 87% at the 0.0062, 0.015, 0.039, 0.095, 0.24, and 0.59 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$).

4 Significant decrease in lettuce dry weight, inhibition of 33 and 54% at the 0.0064 and 0.016 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Williams Multiple Comparison test, $p<0.05$).

5 Significant decrease in oat dry weight, inhibition of 18 and 19% at the 0.25 and 0.63 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Williams Multiple Comparison test, $p<0.05$).

6 Significant decrease in onion dry weight, inhibition of 34, 52, 59 and 86% at the 0.039, 0.095, 0.24 and 0.59 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$). The reviewer determined that the 17% -28% inhibitions observed in the 0.0025, 0.0062 and 0.015 lb ae/A treatment group were likely treatment related, despite the lack of clear dose-response or statistical significance (p ranged from 0.058-0.156).

7 Significant decrease in soybean dry weight, inhibition of 13, 23, and 36% at the 0.0010, 0.0026, and 0.0064 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Williams Multiple Comparison test, $p<0.05$).

8 Significant decrease in tomato dry weight, inhibition of 33, 47, 66, 73, 95 and 96% at the 0.0026, 0.0066, 0.016, 0.039, 0.10, and 0.25 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$).

9 Significant decrease in turnip dry weight, inhibition of 11, 9, 24 and 40% at the 0.0026, 0.0066, 0.016, and 0.039 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Williams Multiple Comparison test, $p<0.05$).

Table 7c: Reviewer-Verified Effect of Dicamba on 21-Day Vegetative Vigor

Species	Results summary for survival (lb ai/A)									
	%	NOAEC	EC_{05}	95%CI	EC_{25}	95%CI	EC_{50}	95%CI	slope	95%CI
Cabbage	100	0.59	>0.59	N/A	>0.59	N/A	>0.59	N/A	N/A	N/A
Corn	100	0.59	>0.59	N/A	>0.59	N/A	>0.59	N/A	N/A	N/A
Cucumber[1]*	60-100	0.095	0.0624	0.00011-0.162	0.373	0.139-16.5	1.29	0.422-19400	1.25	0.207-2.29
Lettuce	97-100	0.016	>0.016	N/A	>0.016	N/A	>0.016	N/A	N/A	N/A
Oat	97-100	0.63	>0.63	N/A	>0.63	N/A	>0.63	N/A	N/A	N/A
Onion[2]*	63-100	0.24	0.271	0.0981-0.365	0.483	0.356-0.658	0.722	0.558-1.55	3.87	1.47-6.26
Ryegrass	100	0.59	>0.59	N/A	>0.59	N/A	>0.59	N/A	N/A	N/A
Soybean	100	0.0064	>0.0064	N/A	>0.0064	N/A	>0.0064	N/A	N/A	N/A
Tomato[3]	27-100	0.039	0.0341	0.0183-0.0485	0.0746	0.0535-0.0953	0.129	0.101-0.171	2.85	1.93-3.77
Turnip	97-100	0.039	>0.039	N/A	>0.039	N/A	>0.039	N/A	N/A	N/A

ND- Not determined. NC- Not calculable. N/A – Not Applicable.

*Endpoints and/or confidence intervals are outside tested range of concentrations and should be interpreted with caution.

1 Significant decrease in cucumber survival, inhibition of 17 and 40% at the 0.24 and 0.59 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$).

2 Significant decrease in onion survival, inhibition of 37% at the 0.59 lb ai/A Dicamba treatment level compared to the negative control (Mann-Whitney U Two-Sample test, $p<0.05$).

3 Significant decrease in tomato survival, inhibition of 50 and 73% at the 0.10 and 0.25 lb ai/A Dicamba treatment levels, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$).

Table 8: Reviewer-Verified Effect of s-Metolachlor on 21-Day Vegetative Vigor

Species	Results summary for height (lb ai/A)									
	height (cm)	NOAEC	IC_{05}	95%CI	IC_{25}	95%CI	IC_{50}	95%CI	slope	95%CI
Cabbage	20.7-23.8	1.2	NC	N/A	>1.2	N/A	>1.2	N/A	N/A	N/A
Corn[1]	92.1-109	0.47	1.11	1.05-1.15	>1.2	N/A	NC	N/A	N/A	N/A
Cucumber[2]	13.3-76.8	0.0049	0.000615	N/A-0.00167	0.00549	0.00351-0.00813	0.0251	0.0195-0.0324	N/A	N/A
Lettuce[3]*	13.7-16.7	0.00033	NC	N/A	NC	N/A	NC	N/A	N/A	N/A
Oat[4]*	63-68.4	0.19	0.415	0.199-0.725	>1.3	N/A	NC	N/A	N/A	N/A
Onion[5]	17-35.6	0.077	0.135	N/A-0.234	0.508	0.362-0.679	1.28	0.898-1.82	N/A	N/A
Ryegrass*	29.7-31.6	1.2	NC	N/A	>1.2	N/A	NC	N/A	N/A	N/A
Soybean[6]	19.7-27.8	0.0051	0.00496	N/A-0.00784	0.0123	0.00974-0.0149	0.023	0.0129-0.041	N/A	N/A
Tomato[7]	10.6-50.5	0.0051	0.00161	0.000209-0.00311	0.0103	0.00754-0.0137	0.0375	0.0303-0.0463	N/A	N/A
Turnip*	32.3-35.5	0.031	0.0587	0.016-0.101	0.317	N/A-3.63	NC	N/A	N/A	N/A

ND- Not determined. NC- Not calculable. N/A – Not Applicable.

*Endpoints and/or confidence intervals are outside tested range of concentrations and should be interpreted with caution.

1 Significant decrease in corn height, inhibition of 10% at the 1.2 lb ai/A s-Metolachlor treatment level compared to the negative control (Dunnett Multiple Comparison test, $p<0.05$). Due to poor fit, regression was not used to calculate the IC_{25} or IC_{50}

2 Significant decrease in cucumber height, inhibition of 35, 60, 75, 80, 82, and 83% at the 0.012, 0.030, 0.077, 0.19, 0.47, and 1.2 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$).

3 Significant decrease in lettuce height, inhibition of 15, 4, 11, 10, and 18% at the 0.00082, 0.0020, 0.0051, 0.013 and 0.032 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett Multiple Comparison test, $p<0.05$). Due to poor fit, regression was not used to calculate the IC_{25} or IC_{50}

4 Significant decrease in oat height, inhibition of 8 and 8% at the 0.49 and 1.3 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Dunnett Multiple Comparison test, $p<0.05$). Due to poor fit, regression was not used to calculate the IC_{25} or IC_{50}

5 Significant decrease in onion height, inhibition of 18, 19, and 52% at the 0.19, 0.47, and 1.2 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Williams Multiple Comparison test, $p<0.05$).

6 Significant decrease in soybean height, inhibition of 28% at the 0.013 lb ai/A s-Metolachlor treatment level compared to the negative control (Dunnett Multiple Comparison test, $p<0.05$).

7 Significant decrease in tomato height, inhibition of 25, 55, 62, 77, and 78% at the 0.013, 0.031, 0.080, 0.19, and 0.49 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$).

[8] Significant decrease in turnip height, inhibition of 9% at the 0.080 lb ai/A S-metolachlor treatment level, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$).

Table 8a: Reviewer-Verified Effect of s-Metolachlor on 21-Day Vegetative Vigor

Species	Results summary for biomass (lb ai/A)									
	weight (g)	NOAEC	IC_{05}	95%CI	IC_{25}	95%CI	IC_{50}	95%CI	slope	95%CI
Cabbage[1]	1.07-2.96	0.0049	0.0111	0.00367-0.0207	0.123	0.0904-0.163	0.653	0.5-0.853	N/A	N/A
Corn[2]*	3.33-5.23	0.47	0.281	N/A-0.588	1.01	0.628-1.47	2.45	0.806-7.44	N/A	N/A
Cucumber[3]	0.887-6.73	0.0049	0.00109	8.71E-05-0.00245	0.0105	0.00768-0.0141	0.0509	0.0416-0.0622	N/A	N/A
Lettuce[4]	0.366-0.834	0.0051	0.00266	N/A-0.00643	0.0107	0.00505-0.0184	0.028	0.0155-0.0507	N/A	N/A
Oat[5]*	1.15-1.42	0.19	NC	N/A	>1.3	N/A	NC	N/A	N/A	N/A
Onion[6]	0.0437-0.314	<0.0049	0.00525	N/A-0.0167	0.0497	0.0254 0.0868	0.237	0.152-0.369	N/A	N/A
Ryegrass	0.905-1	1.2	NC	N/A	>1.2	NC	NC	N/A	N/A	N/A
Soybean[7]	0.947-1.47	0.00082	0.000897	0.0002-0.00174	0.00739	0.00524-0.0101	0.032	0.0152-0.0675	N/A	N/A
Tomato[8]	0.206-5.27	0.0020	0.000635	N/A-0.00128	0.00409	0.00303-0.00536	0.0149	0.0123-0.0181	N/A	N/A
Turnip[9]*	3.22-5.42	0.0020	0.00363	0.000851-0.00715	0.0337	0.024-0.046	0.159	0.0834-0.303	N/A	N/A

ND- Not determined. NC- Not calculable. N/A – Not Applicable.

*Endpoints and/or confidence intervals are outside tested range of concentrations and should be interpreted with caution.

1 Significant decrease in cabbage dry weight, inhibition of 9, 12, 22, 30, 40 and 64% at the 0.012, 0.030, 0.077, 0.19, 0.47 and 1.2 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Williams Multiple Comparison test, $p<0.05$).

2 Significant decrease in corn dry weight, inhibition of 23% at the 1.2 lb ai/A s-Metolachlor treatment level compared to the negative control (Dunnett Multiple Comparison test, $p<0.05$).

3 Significant decrease in cucumber dry weight, inhibition of 28, 39, 58, 74, 81, and 87% at the 0.012, 0.030, 0.077, 0.19, 0.47, and 1.2 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$).

4 Significant decrease in lettuce dry weight, inhibition of 33 and 54% at the 0.013 and 0.032 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Williams Multiple Comparison test, $p<0.05$).

5 Significant decrease in oat dry weight, inhibition of 18 and 19% at the 0.47 and 1.3 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Williams Multiple Comparison test, $p<0.05$).

6 Significant decrease in onion dry weight, inhibition of 34, 52, 59 and 86% at the 0.077, 0.19, 0.47 and 1.2 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$). The reviewer determined that the 17-28% inhibitions observed in the 0.0049, 0.012 and 0.03 lb ae/A treatment group were also likely treatment related, despite the lack of clear dose-response or statistical significance (p ranged from 0.058-0.156).7 Significant decrease in soybean dry weight, inhibition of 13, 23, and 36% at the 0.0020, 0.0051, and 0.013 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Williams Multiple Comparison test, $p<0.05$).

8 Significant decrease in tomato dry weight, inhibition of 33, 47, 66, 73, 95 and 96% at the 0.0051, 0.013, 0.031, 0.080, 0.19, and 0.49 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$).

9 Significant decrease in turnip dry weight, inhibition of 11, 9, 24 and 40% at the 0.0051, 0.013, 0.031, and 0.080 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Williams Multiple Comparison test, $p<0.05$).

Table 8c: Reviewer-Verified Effect of s-Metolachlor on 21-Day Vegetative Vigor

Species	Results summary for survival (lb ai/A)									
	%	NOAEC	EC_{05}	95%CI	EC_{25}	95%CI	EC_{50}	95%CI	slope	95%CI
Cabbage	100	1.2	>1.2	N/A	>1.2	N/A	>1.2	N/A	N/A	N/A
Corn	100	1.2	>1.2	N/A	>1.2	N/A	>1.2	N/A	N/A	N/A
Cucumber[1]*	60-100	0.19	0.123	0.000215-0.323	0.748	0.276-34.2	2.62	0.845-41400	1.24	0.206-2.27
Lettuce	97-100	0.032	>0.032	N/A	>0.032	N/A	>0.032	N/A	N/A	N/A
Oat	97-100	1.3	>1.3	N/A	>1.3	N/A	>1.3	N/A	N/A	N/A
Onion[2]*	63-100	0.47	0.535	0.192-0.726	0.975	0.712-1.34	1.48	1.13-3.21	3.72	1.44-6
Ryegrass	100	1.2	>1.2	N/A	>1.2	N/A	>1.2	N/A	N/A	N/A
Soybean	100	0.013	>0.013	N/A	>0.013	N/A	>0.013	N/A	N/A	N/A
Tomato[3]	27-100	0.080	0.0665	0.0359-0.0944	0.145	0.105-0.185	0.251	0.197-0.333	2.86	1.93-3.78
Turnip	97-100	0.080	>0.080	N/A	>0.080	N/A	>0.080	N/A	N/A	N/A

ND- Not determined. NC- Not calculable. N/A – Not Applicable.
*Endpoints and/or confidence intervals are outside tested range of concentrations and should be interpreted with caution.
1 Significant decrease in cucumber survival, inhibition of 17 and 40% at the 0.47 and 1.2 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$).
2 Significant decrease in onion survival, inhibition of 37% at the 1.2 lb ai/A s-Metolachlor treatment level compared to the negative control (Mann-Whitney U Two-Sample test, $p<0.05$).
3 Significant decrease in tomato survival, inhibition of 50 and 73% at the 0.19 and 0.49 lb ai/A s-Metolachlor treatment levels, respectively, compared to the negative control (Jonckheere-Terpstra Step-Down test, $p<0.05$).

Plant Injury Index*											
Control	Cabbage	Corn	Cucumber	Lettuce	Oat	Onion[1]	Ryegrass	Soybean	Tomato	Turnip	Formulation Blank
0-12	0-36	0-26	0-88	0-46	0-32	0-92	0-12	0-48	0-100	0-26	N/A

*0- No effect; 10-30- Slight effect; 40-60- Moderate effect; 70-90- Severe effect; 100 = death of entire plant.

[1] A single plant in the onion controls (replicate F) showed moderate (60) signs of chlorosis, leaf curl and necrosis by D21, which are common symptomologies of dicamba exposure. The Day 21 height of this plant was also much reduced, relative to other control plants (13 cm vs. overall control mean of 35.4 cm). The reviewer qualitatively examined whether removal of this plant in the plant height calculations would impact the NOAEC/LOAEC endpoints and concluded that it was unlikely to change the results.

Dicamba (based on measured test concentrations)
Monocot
Most sensitive monocot: Onion, based on dry weight

EC_{50}/IC_{50}: 0.118 lb ai/A — 95% C.I.: 0.076-0.184 lb ai/A
EC_{25}/IC_{25}: 0.0248 lb ai/A — 95% C.I.: 0.0127-0.0434 lb ai/A
EC_{05}/IC_{05}: 0.00262 lb ai/A — 95% C.I.: N/A-0.00837 lb ai/A
NOAEC: <0.0025 lb ai/A
Slope: N/A — 95% C.I.: N/A

Dicot
Most sensitive dicot: Tomato, based on dry weight

EC_{50}/IC_{50}: 0.00761 lb ai/A — 95% C.I.: 0.00629-0.0092 lb ai/A
EC_{25}/IC_{25}: 0.00208 lb ai/A — 95% C.I.: 0.00155-0.00272 lb ai/A
EC_{05}/IC_{05}: 0.000323 lb ai/A — 95% C.I.: 1.22E-05-0.000647 lb ai/A
NOAEC: 0.0010 lb ai/A
Slope: N/A — 95% C.I.: N/A

s-Metolachlor (based on measured test concentrations)
Monocot
Most sensitive monocot: Onion, based on dry weight

EC_{50}/IC_{50}: 0.237 lb ai/A — 95% C.I.: 0.152-0.369 lb ai/A
EC_{25}/IC_{25}: 0.0497 lb ai/A — 95% C.I.: 0.0254-0.0868 lb ai/A
EC_{05}/IC_{05}: 0.00525 lb ai/A — 95% C.I.: N/A-0.0167 lb ai/A
NOAEC: <0.0049 lb ai/A
Slope: N/A — 95% C.I.: N/A

Dicot
Most sensitive dicot: Tomato, based on dry weight

EC_{50}/IC_{50}: 0.0149 lb ai/A — 95% C.I.: 0.0123-0.0181 lb ai/A
EC_{25}/IC_{25}: 0.00409 lb ai/A — 95% C.I.: 0.00303-0.00536 lb ai/A
EC_{05}/IC_{05}: 0.000635 lb ai/A — 95% C.I.: N/A-0.00128 lb ai/A
NOAEC: 0.0020 lb ai/A
Slope: N/A — 95% C.I.: N/A

Total Formulation A21472C (calculated from Dicamba endpoints based on measured concentrations)

Monocot

Most sensitive monocot: Onion, based on dry weight

EC_{50}/IC_{50}: 0.95 lb/A	95% C.I.: 0.61-1.48 lb/A
EC_{25}/IC_{25}: 0.20 lb/A	95% C.I.: 0.102-0.35 lb/A
EC_{05}/IC_{05}: 0.0211 lb/A	95% C.I.: N/A-0.068 lb/A
NOAEC: <0.0207 lb/A	

Dicot

Most sensitive dicot: Tomato, based on dry weight

EC_{50}/IC_{50}: 0.061 lb/A	95% C.I.: 0.051-0.074 lb/A
EC_{25}/IC_{25}: 0.017 lb/A	95% C.I.: 0.0125-0.022 lb/A
EC_{05}/IC_{05}: 0.0026 lb/A	95% C.I.: 0.00010-0.0052 lb/A
NOAEC: 0.0081 lb/A	
Slope: N/A	95% C.I.: N/A

D. STUDY DEFICIENCIES:

1. The physico-chemical properties of the test material were not reported.

2. Soil CEC and % moisture were not reported.

E. REVIEWER'S COMMENTS:

The reviewer and study author results were in agreement for the most sensitive monocot and the most sensitive dicot. Based on the study author's results, the most sensitive monocot was onion, based on dry weight, with NOER and ER_{25} values of 0.00641 and 0.00895 lb ai/A nominal Dicamba concentrations, respectively (0.0123 and 0.0172 lb ai/A nominal s-Metolachlor, respectively); and the most sensitive dicot was tomato, based on dry weight, with NOER and ER_{25} values of 0.0010 and 0.00219 lb ai/A nominal Dicamba, respectively (0.00197 and 0.00421 lb ai/A nominal s-Metolachlor, respectively). In terms of total formulation, the most sensitive monocot was onion, based on dry weight, with NOER and ER_{25} values of 0.0517 and 0.0722 lb formulation/A, respectively; and the most sensitive dicot was tomato based on dry weight, with NOER and ER_{25} values of 0.00806 and 0.0177 lb formulation/A, respectively.

Based on the reviewer's results, the most sensitive monocot was onion, based on dry weight, with NOAEC, IC_{05} and IC_{25} values of <0.0025, 0.00262 and 0.0248 lb ae/A measured Dicamba concentrations, respectively (<0.0049, 0.00525 and 0.0497 lb ai/A measured s-Metolachlor, respectively); and the most sensitive dicot was tomato, based on dry weight, with NOAEC and IC_{25} values of 0.0010 and 0.00208 lb ai/A measured Dicamba, respectively (0.0020 and 0.00409 lb ai/A measured s-Metolachlor, respectively). In terms of total formulation, the most sensitive monocot was onion, based on dry weight, with NOAEC, IC_{05} and IC_{25} values of <0.0207, 0.0211 and 0.20 lb formulation/A, respectively; and the most sensitive dicot was tomato based on dry weight, with NOAEC and IC_{25} values of 0.0081 and 0.017 lb formulation/A, respectively. The reviewer also notes that cucumber and soybean exhibited very similar sensitivity as tomato, given their most sensitive IC_{25}s of 0.0028 and 0.0037 lb ae/A measured Dicamba, respectively (based on height for cucumber and biomass for soybean).

The difference between the study author and reviewer's NOAEC and IC_{25} values for the most sensitive monocot (onion) and dicot (tomato) speciesare a result of the study author using nominal concentrations, while the reviewer used the analytically verified measured concentrations and for onion dry weight, due to

differences in the statistical analyses between the study author and reviewer and the reviewer's consideration that inhibitions of 17-28% at the three lowest treatment doses could not be excluded as representing potential treatment-related effects. Therefore, the reviewer concluded that the NOAEC endpoint for onion dry weight was non-definitive (<) and recommends that the IC_{05} be used in lieu of the NOAEC for quantitative use in risk assessments. The reviewer's results are presented in the Executive Summary and Conclusions sections of this DER.

The in-life portion of this study was initiated on September 20, 2016 and completed on December 15, 2016.

F. CONCLUSIONS:

This study is scientifically sound and is classified as acceptable. The most sensitive monocot was onion, based on dry weight, with NOAEC, IC_{05} and IC_{25} values of <0.0025, 0.00262 and 0.0248 lb ai/A measured Dicamba concentrations, respectively (<0.0049, 0.00525 and 0.0497 lb ai/A measured s-Metolachlor, respectively); and the most sensitive dicot was tomato, based on dry weight, with NOAEC and IC_{25} values of 0.0010 and 0.00208 lb ai/A measured Dicamba, respectively (0.0020 and 0.00409 lb ai/A measured s-Metolachlor, respectively). In terms of total formulation, the most sensitive monocot was onion, based on dry weight, with NOAEC, IC_{05} and IC_{25} values of <0.0207, 0.0211 and 0.20 lb formulation/A, respectively; and the most sensitive dicot was tomato based on dry weight, with NOAEC and IC_{25} values of 0.0081 and 0.017 lb formulation/A, respectively.

Most sensitive monocot and EC_{25}/IC_{25}: Onion (based on dry weight, 0.0248 lb ae Dicamba/A)
Most sensitive dicot and EC_{25}/IC_{25}: Tomato (based on dry weight, 0.00208 lb ae Dicamba/A)

Most sensitive monocot and EC_{25}/IC_{25}: Onion (based on dry weight, 0.0497 lb s-Metolachlor/A)
Most sensitive dicot and EC_{25}/IC_{25}: Tomato (based on dry weight, 0.00409 lb s-Metolachlor/A)

Most sensitive monocot and EC_{25}/IC_{25}: Onion (based on dry weight, 0.20 lb formulation/A)
Most sensitive dicot and EC_{25}/IC_{25}: Tomato (based on dry weight, 0.017 lb formulation/A)

III. REFERENCES:

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